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Hyperloop One's Transport Economist Makes The Freight Case



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Most people who read about what's going on at Hyperloop One in the press or on social media (<http://twitter.com/hyperloopone>) probably think we're a group of civil and mechanical engineers cutting steel and welding tubes. That's true, but little do they know we have a whole team of transportation economists and analysts on staff studying the dynamics of city-pairs and passenger and cargo flows and comparing the costs and benefits of Hyperloop systems with those of traditional transport modes like cars, trucks, railroads and airplanes. I'm one of those "embedded economists" working amid the engineers, and a couple of weeks ago I had the privilege of presenting our work at the Transportation Research Board's annual conference (<http://www.trb.org/AnnualMeeting/AnnualMeeting.aspx>) in Washington, D.C.

Thousands of us transport geeks show up at the TRB conference every year; it's like Woodstock for people who obsess about agglomeration, livability models and mode shift, data analysis, and innovative ideas.

The TRB is part of the National Academies of Sciences, Engineering, and Medicine (<http://nas.edu/>) and does terrific, rigorous research into global transportation infrastructure issues and produces tangible results. Hyperloop One is proud to contribute to the work at TRB so we can share our insights, communicate with academia, and exchange thoughts with practitioners.

My panel at the TRB drew one of the biggest audiences at the conference, as it was focused on the sexy topic of how transformational technologies will shape the future of intermodal freight, a fancy term for the movement of containers via rail, ship and truck without touching the freight itself. Hyperloop has a big role to play in the future of intermodal freight, given that we're planning to be moving containers and pallets on-demand at speeds far in excess of today's rail and highway options and far less expensively than by air freight, while integrating as seamlessly as possible with those modes.

Our vision at Hyperloop One is to connect cities into mega-regions, and turn metro areas into metro stops. This will inevitably improve the efficiency of freight supply chains. By connecting two distant metros, Hyperloop One creates a geographical cluster which could help reduce inventory costs, promote even more just-in-time strategies, and expand same-day delivery service areas. And, by extending the effective economic boundary of a city (Fig. 1), firms could have better accessibility to manufacturing hubs and retail stores and save travel time.

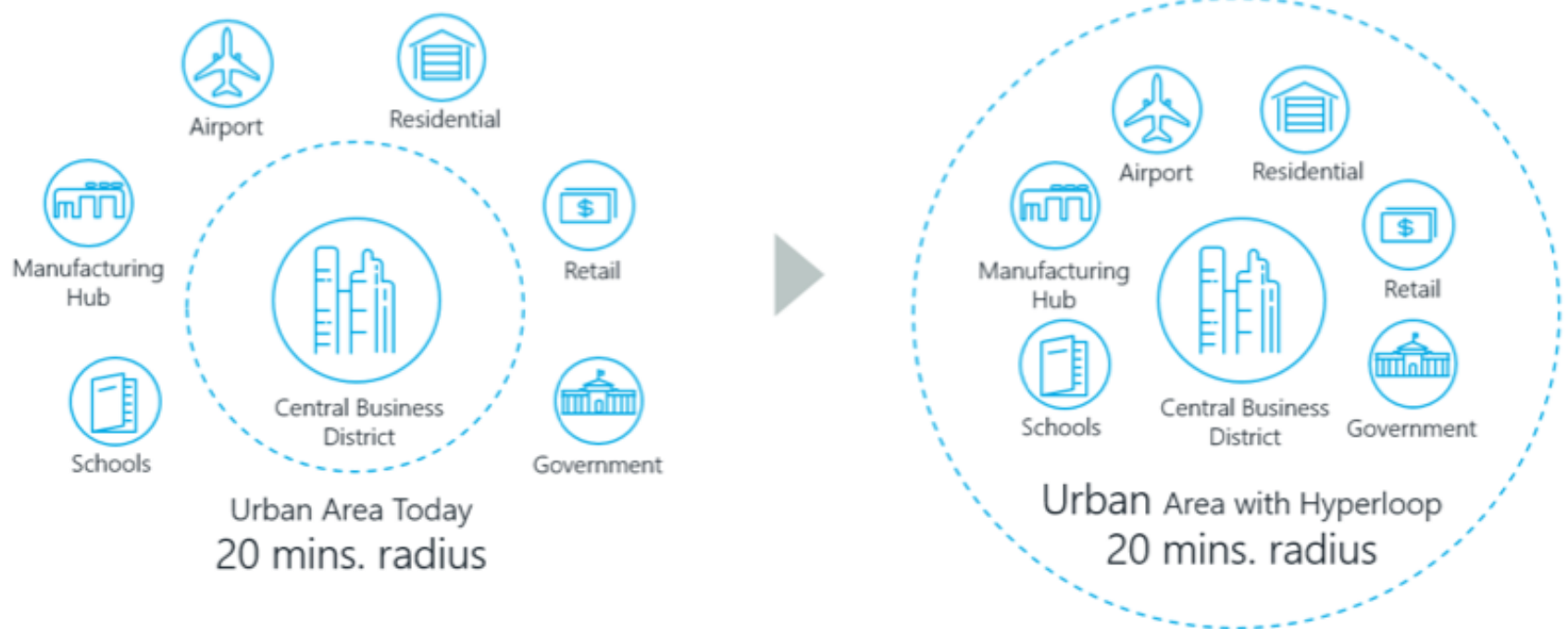


Figure 1. Better accessibility with Hyperloop

Economists have a name for this kind of clustering of people and firms—agglomeration—and executing the concept enables better matching of supply chain players and leads to more innovative ideas among firms, which in turn generates higher returns. Agglomeration can benefit regional economies through greater specialization and competition. Figure 2 presents the relationship between productivity and urban density in every U.S. state from the remarkable work of Ciccone and Hall (1993). (<http://www.nber.org/papers/w4313>) There is a clear trend: Density increases average labor productivity. Hyperloop can drive that productivity even higher through “virtual” density, as in the kind that doesn’t generate the disadvantages of agglomeration such as as traffic, pollution, and vehicle accidents.

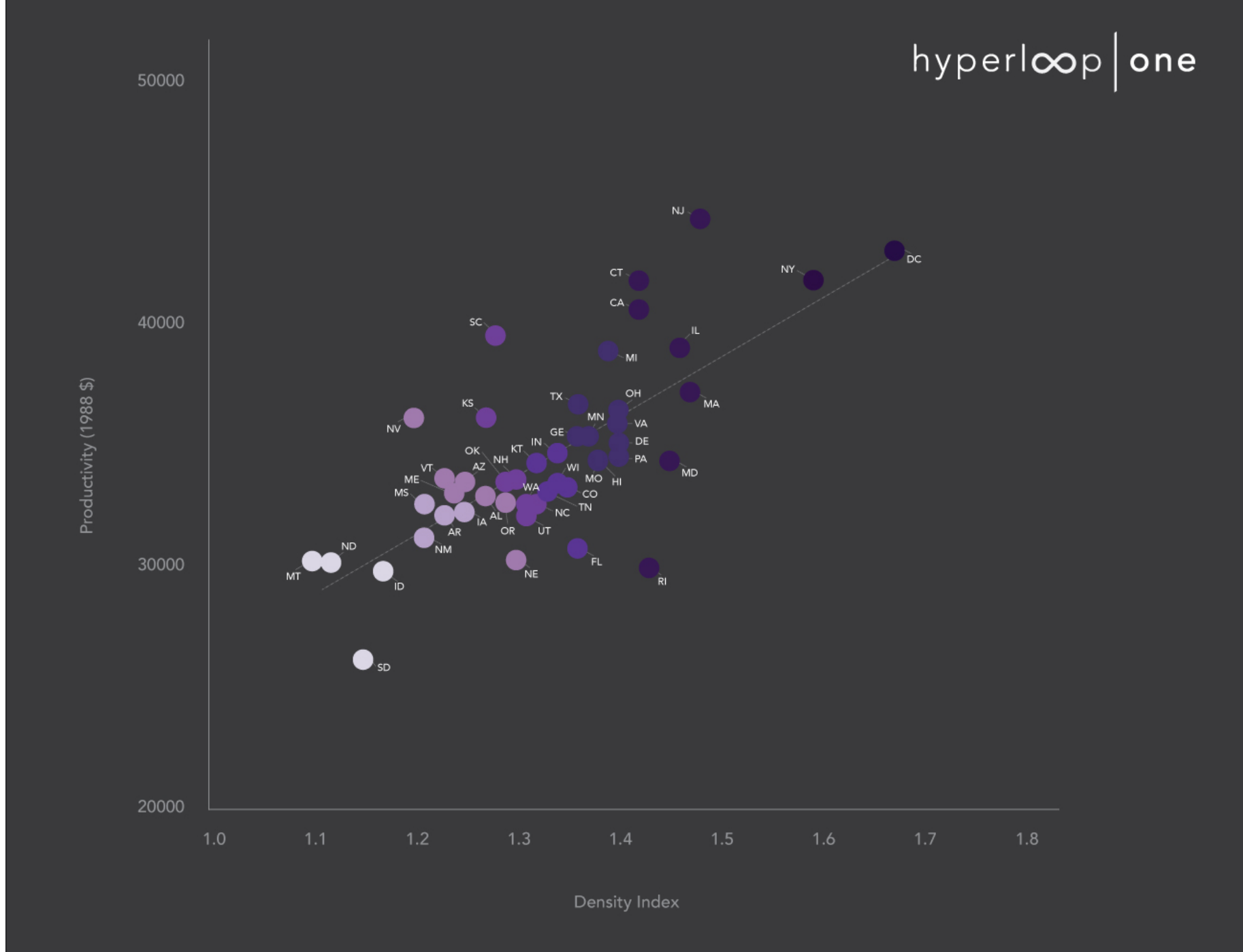


Figure 2. Productivity and Density (Ciccone and Hall, 1993)

The presentation was followed by great and challenging questions from the audience and the panel host. I thought I would share some of the questions, along with my answers, here on the Hyperloop One blog.

Q: It seems Hyperloop’s main market is the inter-city connection between metropolitan areas. Is it reasonable for Hyperloop to “be anywhere and move anybody”? Have you considered local communities? Is Hyperloop’s service equitable?

A: We think Hyperloop could serve local communities. In November 2016, the company released its vision for last-mile integration by allowing autonomous pod-like vehicles to load directly into the Hyperloop for speedy and direct inter-city travel (<https://hyperloop-one.com/blog/last-mile-meets-other-500-miles-hyperloop-ones-autonomous-vision>). People who live miles away from the Hyperloop portal (or station) can order a ride directly into the

Hyperloop with their mobile phone. This last-mile solution has meaningful economic implications by expanding transit's catchment area, reducing waiting and transfer time, and freeing up parking spaces near the portal. Such design is in line with the concept of smart mobility, a rising trend seeking to integrate information technology into transportation. In addition, our engineers are actively working on developing a low-cost way to switch passenger pods from one tube to another similar to highway on-ramps and off-ramps. That would allow us to build more portals along the tube to serve more local communities. Collectively, Hyperloop's design and technology can improve mobility at a low cost and make it available for people wherever they live.

Q: Why does Hyperloop provide cheap tickets given that Hyperloop offers better service? Does this make economic sense?

A: A study we released last summer for a Helsinki-to-Stockholm route (<https://hyperloop-one.com/blog/we-ran-the-numbers-on-euro-hyperloop>) built in an assumption of one-way tickets for 27 euros, a fraction of the cost of airfare on the same route. We think that tickets can be this cheap because we believe Hyperloop could potentially have lower construction and operation costs than high-speed rail. Cost is the fundamental driver of ticket price. On the other hand, we also believe the ticket prices are driven by the services of other transportation modes in the market. It also depends on the operator. One Hyperloop One system could charge a premium based on its dramatic reduction in travel time, and some could change fares dynamically so that last-minute travelers pay something closer to air fares while those who book in advance pay the equivalent of a bus ticket. We're developing a broader ticket-pricing strategy now.

Q: Why do you think freight is that sensitive to travel time? There are studies claiming that customers are willing to wait a couple of days to receive products.

A: Freight sensitivity to time is heterogenous – fast delivery is in high demand in some cases but not necessary in others. A 2007 meta-analysis of empirical studies by Zamparini and Reggiani (<http://www.tandfonline.com/doi/abs/10.1080/01441640701322834?journalCode=ttrv20>) on the freight value of travel time in Europe and North America differed widely depending on the delivered product types, location of suppliers and receivers, delivery frequency, and size. For example, out of the 44 investigated studies, five found the

freight value of travel time is lower than \$5 per hour while another 3 studies found it could reach \$50 per hour. There is a clear market segmentation. We believe Hyperloop can bring huge benefits to time-sensitive deliveries.

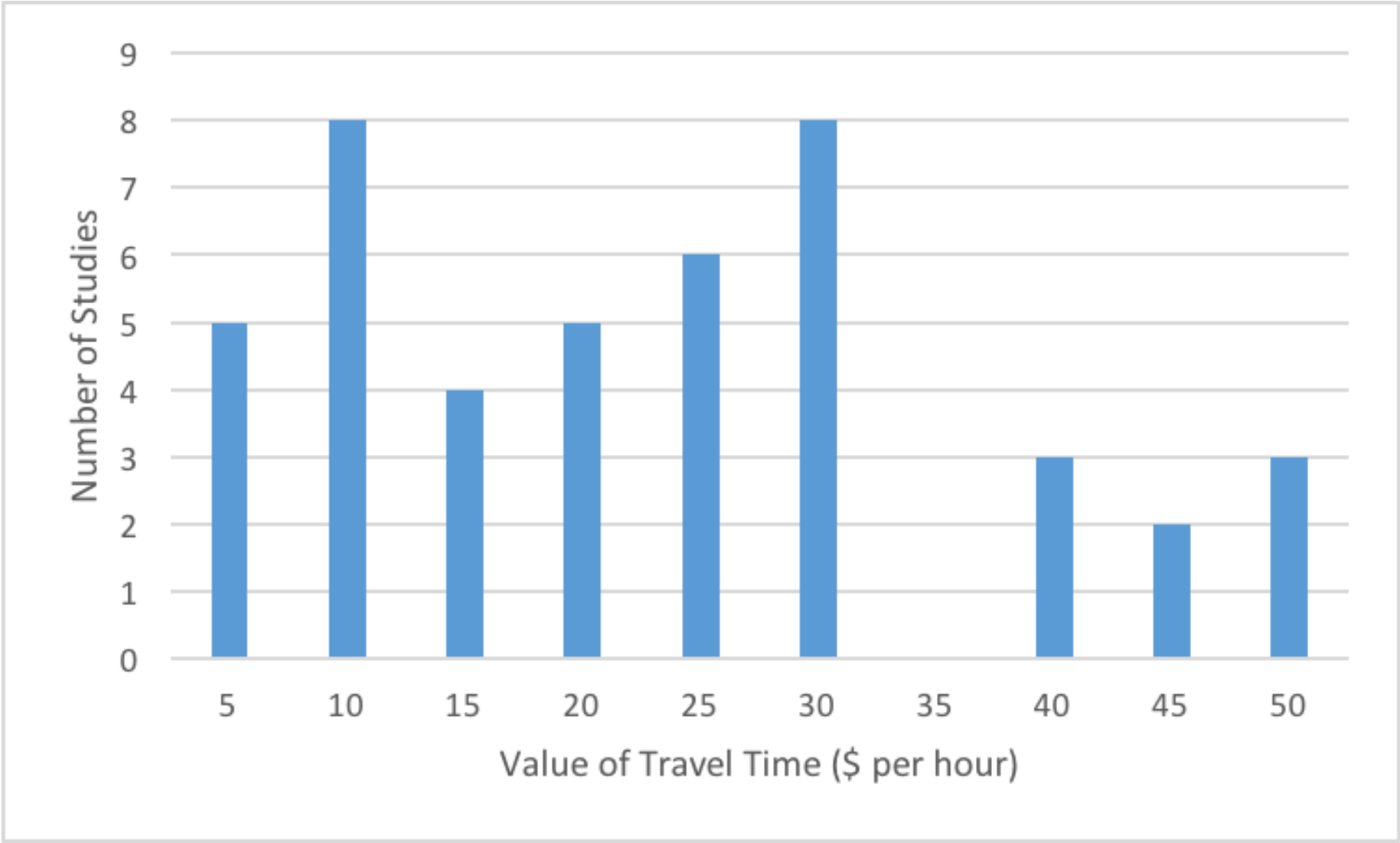


Figure 3. Heterogeneity in freight value of travel time (Zamparini and Reggiani, 2007)

Q: Hyperloop will be a highly automated system. Won't that lead to higher unemployment?

A: Not necessarily. Bringing this kind of innovative technology to market requires a lot of people working together to develop and upgrade the systems and components. Hyperloop One has and will keep creating jobs all around the world to achieve our mission. We're talking about doubling in headcount (500 people) between now and the early part of next year, and we're projected to generate more than 1,000 indirect and induced job opportunities in this year alone.

The panel ended with great interest from conference attendees. Apart from the discussion, we also participated in a poster session and brought our work to several research committee meetings. We understand and have emphasized the importance of establishing joint efforts between the academic community and Hyperloop One to study its technology impact. We

identified several topics such as travel mode choice, spatial interaction, and agglomeration economics. Keep following us here on the blog and on Twitter (<http://www.twitter.com/hyperloopone>) and Facebook (<https://www.facebook.com/HyperloopOne/?fref=ts>), or subscribe to our newsletter (<http://eepurl.com/ciPj9b>), for more updates and analysis.

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